Protecting Your Brand ...from Airborne Contamination

➤ Why is it a Concern?

Adulteration of food and beverage products is a primary concern for any processor or manufacturer. The one potential source of contamination every food or beverage product is guaranteed to come in contact with is the facility air. Contaminated product can result in quality defects, potential food safety issues, and hidden costs if the adulteration is severe enough to result in the disposal of product or even worse, a recall.

Quality defects arising from adulteration can affect product appearance, taste, aroma, or other attributes which may impact product appeal and performance. Adulterated product can also result in food safety issues such as injury, illness and in worst case, even death. Finally, the costs associated with quality control and product recalls are significant and may be avoided through the use of Good Manufacturing Practices (GMPs).

Each of the issues above (quality defects, food safety issues, and hidden costs) is capable of diluting a brand's image and providing the impetus for consumers to explore and/or select alternate products and brands. Controlling adulteration from airborne contaminants is a critical part of any contamination control or food safety program.

➤ How Can Air Contaminate a Food or Beverage Product?

Airborne contaminants come from a wide variety of sources and are continually introduced into the facility. These contaminants may occur naturally or may be introduced via the manufacturing process itself.

Naturally occurring contaminants include bacteria, fungi, yeasts, viruses, sand, organic matter, animal excrements and pollen. Man-made contaminants include tobacco smoke, unburned hydrocarbons, fly ash, farm dusts, construction dusts, engine exhausts, and unfiltered industrial exhausts. Manufacturing operations generate contaminants through garments, packaging products, and by performing operations. Other contaminants are those generated by people, such as particles of skin, dandruff, make-up, hair and clothing fibers. All types of contamination are potentially harmful to the manufacturing process and product quality.

Airflow in a facility is capable of supporting and spreading particulate from 0.001 to 1000 microns in size. A micron is 1/25,000 of an inch. For perspective, the average human hair is approximately 100 microns in diameter. The primary air quality concern for most food and

beverage processors is microbial contamination. Microorganisms range from 0.2 –10 microns in length. Airflow in a facility is also capable of supporting the spread of all microbes including pathogens, spores, molds, yeast, and any other potentially harmful microorganisms. Additionally, any particulate found in facility air can act as transport mechanisms for the various biological contaminants.

► How is Air Quality Measured?

Air quality in a facility is measured using portable sampling devices. These devices are placed in predetermined locations throughout the facility on a regular schedule.

The Anderson Air Sampler filters (Anderson Samplers Inc., Atlanta GA) environmental air, separating the airborne contaminants by size. Each airborne contaminant is then captured on a petri dish containing a biological medium. Once captured, the airborne contaminants may be analyzed for particle type, frequency or size; and cultures may be grown to determine the type and number of biological contaminants such as bacteria, molds or yeast.

The BioTest Centrifugal Air Sampler (Biotest Diagnostics Inc., Fairfield NJ) is used for more general monitoring. It pulls air across a microbial growth strip, impacting microorganisms onto a media surface. The strips are then incubated and counted. There are different types of media available for determining different types of organisms.

► How do You Control Air Quality?

The primary way to control facility air quality is through the air handling system. Air handling systems are comprised of several components including HVAC (heating, ventilating, and air conditioning system), filters, pressure differentials, and the overall airflow design. Other factors such as personnel hygiene, garments, and traffic flow also contribute to the quality of facility air. These elements are discussed in greater detail below.

Air Pressure: Air pressure is used to direct the airflow from the most critical areas to outlying areas in a facility. High-pressure areas (positive pressure regions) are created in critical environments with each surrounding area having subsequently reduced air pressure. This creates an airflow pattern which forces clean air out of any cracks or openings, preventing outside air and potential airborne contamination from passing into the most critical operations. The positive pressure also creates an outward flow when doors are opened, reducing the entry of outside air and contaminants.

Filters: Filters are devices used to remove particulate, including microorganisms, from air or other gases. Filters can have a wide range of effectiveness and vary in use depending on the type of contaminants to be removed. HEPA (High Efficiency Particulate Air) filters are disposable extended-pleated dry-type filters and are among the most effective and commonly used filters for

removing airborne contaminants. Filters are added to the air-handling systems to remove airborne contaminants prior to discharge into critical environments.

Design: The design of the ventilation system to achieve desired airflow patterns is also an essential part of reducing airborne contamination. The intent of the air handling system is to purge the room of airborne contaminates. This is achieved by removing the existing air and replacing it with filtered, clean air. The effectiveness in achieving this goal is not only a result of the type of air filter but also the number of room air changes per hour and the air distribution pattern within the room. Improperly designed exhaust and ventilation systems may result in inadequate room air turnover or airflow patterns, which fail to properly wash portions of the room with clean air. For example, consider a room with only one air supply diffuser in the center of the ceiling and one exhaust register a short distance away on the sidewall of the room. In this arrangement, many areas within the room never get washed with clean air. Increasing the number of air changes will help the dilution process, but only to a certain point. Additional room air changes may aggravate the situation as the increased velocities stir up more dust and reintroduce particles into the room.

Materials of Construction: The materials utilized in the construction of a facility and equipment can contribute significantly to airborne contaminants. Older facilities may not allow for material selection; however, when selecting materials for new construction the following guidelines should be followed. Materials of construction should:

- Be free of discontinuities, openings, pits, porosity, crevices, etc., by which contaminating material can be retained or enter.
- Be resistant to abrasion or other damage in the normally expected usage.
- Resist deterioration leading to particle formation in sizes potentially hazardous.
- Be capable of absorbing building strains or movement.

Clothing: Garments worn by personnel in critical operations are designed to eliminate contaminants, which may be emitted by personnel during routine operations. Gloves, hairnets, smocks, and coveralls are examples of the type of garments, which may effectively reduce airborne contaminants in critical environments.

Other: Other considerations when examining the air handling system of a facility include heating and cooling systems, traffic flow patterns, and personnel hygiene. Activities taking place in the room such as boxing, packaging or mixing dry ingredients also must be taken into account. Each of these has potential to impact the quality of the facility air and air handling system. Programs and practices should be implemented to minimize any contamination resulting from these sources.

➤ Conclusions

It is clear that facility air quality is a critical component of any contamination control or food safety program. There are many challenges associated with the implementation of an air quality program, but food and beverage processors can reduce quality defects, potential food safety issues, and hidden costs through an effective program. An air quality program is worth the investment to **protect your brand equity**.

For specific products and procedures, contact your Ecolab Representative.

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